REVIEW

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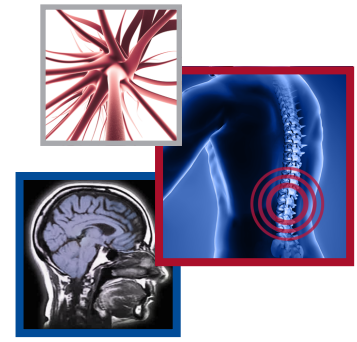
Pain Management



The importance of medical education in the changing field of pain medicine

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Practice Points

- Despite of many advances in pain medicine, pain is highly prevalent and continues to be inadequately treated worldwide.
- Medical education is recognized as a key element in closing this gap.
- The current status of medical education in pain medicine is inadequate and inconsistent globally.
- There are many challenges including the pedagogy, outcomes measures, standardized curricula, lack of quality mentors and lack of funding and resources.
- Effective medical education requires an integrated and innovative approach aimed at the right audience at the right time and delivered by knowledgeable and compassionate mentors.

SUMMARY Suffering chronic pain is a global epidemic that requires a closer look on how we are educating trainees to become more effective in pain management. The vast majority of medical professionals will encounter treatment of pain throughout their career. Our current system for educating these medical professionals is flawed in a number of ways. Improving pain education will narrow the gap between over and under treatment of acute and chronic pain. Reviews have demonstrated dissatisfaction among practitioners throughout the world on how pain education is currently conducted. Changing the educational process will require support from several areas: medical educators, clinicians, policymakers, administrators and several other organizations

KEYWORDS
• cancer pain • chronic pain • curriculum • integrated course • medical education • pain assessment • pain education • pain treatment • teaching • training programs

Pain is recognized as both a symptom and under certain circumstances a disease in its own right [1,2]. According to the National Institutes of Health, pain has become one of most pressing public health problems [3,4]; in fact it is regarded as a 'grand challenge' with global impact [3,5]. It is the most common complaint for which people seek medical care in the USA [4]. It affects more people than heart disease, diabetes and cancer combined [6]. The overall prevalence of chronic pain is 33% in the USA (i.e., more than 100 million Americans) and 25–30% in Europe (i.e., 80 millions Europeans) [4,7]; in other words, at least one in every three or four adults experiences chronic pain. Consequently, it results in immeasurable suffering, significant disability and vast healthcare costs [8–11].

We have seen tremendous progress in both clinical and basic pain research regarding pain mechanisms and effective therapies during the last three decades [11]. Global and local efforts and organizations such as the International Association for the Study of Pain, World Institute of Pain and numerous local pain societies are attempting to establish best pain practice, research and education. In addition, adequate pain care is recognized as a patient/human right [12]. Despite all of these advances, pain is paradoxically inadequately assessed and poorly managed [13–15]. One important reason contributing to this discrepancy is the inadequate training of healthcare providers in providing effective pain management [4,16–19]. This article will review the critical role of pain

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education at the pre-licensure level including its current status, challenges and opportunities in the changing field of pain medicine.

Basis for improving medical education in pain medicine

It is self-evident that education is a prerequisite for excellence in clinical care. Given the current pain epidemic in both under and over treatment, improvement in pain education will fill a major gap [3,13,2021]. The National Institute of Medicine has designated pain education a national priority [4]. The insufficient training about best practice and therapeutic options of acute, cancer and chronic pain has been identified as a key barrier to optimal pain management [22–24]. For instance, up to 90% of family medicine residents were inadequately trained to treat cancer pain in one study [25]. Indeed, many academic and nonacademic practitioners report inadequacy in their own training to manage chronic pain [26–28]. As a result, many nonpain specialist physicians may not be willing to take on these patients and initiate timely pain assessment and management, including appropriate referrals to pain specialists. Knowledgeable but also compassionate pain care is considered a core responsibility of health professionals [29] and is associated with better and cost-effective treatment outcomes [30,31].

It is believed that improving medical education is the most effective long-term solution for inadequate pain treatment [32,33]. The need to treat pain exists across nearly all medical specialties and primary care. In order for this ubiquitous demand to be adequately met, compassionate and competent practitioners are needed. In order to help prepare competent and compassionate clinicians to deal with pain patients effectively, early exposure to pain education during their training is essential. During this formative period, trainees tend to be more receptive [21,23,34,35]. The education effort should continue throughout residency and post-residency in order to reinforce growing knowledge and to sustain a positive attitude toward pain management. Huge benefits can be reaped from this approach since it will enhance the skills and attitudes of future practitioners who become more comfortable and willing to treat pain patients [21,34]. A recent crossover study found that even a brief but intensive curriculum in palliative care using patient experience, an online pain module and reflective essay significantly improved students' knowledge and attitudes [36]. A timely and effective assessment and management of common pain conditions will help prevent transition of acute conditions into chronic ones and further reduce the burden of subsequent pain management [4,37].

Current status of medical education in pain medicine

Despite a widespread awareness of the need for educational and training programs for physicians, progress has been slow [16,38,39]. The development of a curriculum on pain for medical schools was developed more than 25 years ago by the International Association for the Study of Pain (IASP) [38], with the latest (interprofessional) version published in 2012 [40] does not seem to have had the necessary impact. In fact, the current state of medical education in pain medicine is characterized as inadequate and fragmented to address the needs of physicians, patients and society [23,24,41–47]. A recent review examining pain education from a global perspective (the USA, Canada, the UK, Finland, Australia, New Zealand and India) showed inadequacy and dissatisfaction among practitioners [23]. A 2008 symposium on pain management aimed at medical school students pointed out only 3% of medical schools in the USA had some designated component of their curricula addressing pain [48]. In a more recent study examining the curricula of 117 US and Canadian medical schools, the mean number of hours devoted to pain education was 11.1 h per program (range, 1–31 h) with little or no coverage on many topics included in the IASP core curriculum [45]. In general, the US schools provided less pain education than Canadian counterparts in this study [45].

Other developed countries face similar concerns. Mandatory, systematic training and research in pain management does not exist at any level of medical education in Europe [21]. In a recent survey by the Special Interest Group on Pain Education of the British Pain Society, pain education in the curricula of health professionals is 'woefully inadequate given the burden of pain in the general population in the UK [49]. In its second report including 108 programs across medicine, dentistry, midwifery, nursing, occupational therapy, pharmacy, physiotherapy and veterinary sciences, pain education accounted for less than 1% of program hours for healthcare professionals with pain-related content comprised only 12 h on the average [46]. A study of Finnish

undergraduate medical school education reported that conventional topics such as anatomy and physiology were well covered but found a lack of teaching about the concept of multidisciplinary care in pain management and a need for improvement in teaching quality and methods [50]. Studies from other developed countries (Australia and New Zealand) produced similar results [47,51].

Although data are limited, the situation is worse in developing countries. A recent impression-based survey from seven medical centers from developing countries (India, China, Indonesia, Philippines, Thailand, Nigeria and Guatemala) suggested very limited availability of education in acute pain management in medical, nursing or pharmacy schools [52]. Pain control is not even considered a priority [52]. In a survey from the IASP's chapters in the developing countries, more than 90% of the respondents concurred that pain recognition and management was a significant challenge in their populations [53]. Furthermore, despite the fact that 50% of respondents to this survey stated they attended formal pain related courses, more than 90% admitted that this training was not sufficient to support their clinical demands as they started their clinical practice [53].

Pain education has also been found to be inadequate in many allied health professions including undergraduate nursing, physician assistant, physical and occupational therapy, pharmacy and dentistry programs [54–59,60]. For example, in a faculty survey of accredited physical therapy education programs in North America, the amount of time spent on pain was 4 h on an average [56]. One study found the pain curriculum is poorly developed and presented at many US schools of pharmacy. Psychology training programs have been slow in response to a long recognized need for pain education for psychologists [4,61]. Furthermore, a recent national survey found there are substantial variations in pain training among practitioners of integrative medicine including chiropractors and acupuncturists [62].

Challenges & opportunities in medical education in pain medicine

Despite the abundance of guidelines, one challenge in pain education is the lack of a balanced and consistent delivery of pain content [24,38]. Using IASP's recently released pain curriculum outline based on four core domains including multidimensional nature of pain, pain assessment and measurement, management of pain and clinical conditions, there were still substantial gaps in pain content across and within the University of Washington's six health sciences schools. There was very limited coverage on the ethics of pain and on the specialty topics of geriatric, pediatric, acute, visceral and cancer pain despite IASP recommendations for coverage in the multidimensional nature and clinical conditions domains, respectively [63]. In other studies, there is also a lack of coordination between preclinical and clinical curricula in most programs [64,65]. Pain is a broad topic that integrates so much of what preclinical students are learning: neuroscience, physiology, anatomy, biochemistry, pharmacology, behavior science, medical ethics and clinical skills. Therefore, it is recommended that faculty from multiple disciplines should be part of the curriculum development [32,33]. A balance and consistency in delivery of pain content maximize the prospects for producing future well-rounded clinicians.

Another daunting challenge in pain education is the pedagogy. Traditional didactic lectures were the most common teaching method. However, students may not be able to translate theory to practice without proper clinical exposure and mentoring [24]. A recent survey of members of the American Academy of Pain Medicine, which asked participants to rank the priority of learning objectives for a comprehensive pain management curriculum, reported the highest ranked components were all clinical skills [32]. In a short structured regional anesthesia course compared with traditional teaching, fourth year medical students randomly assigned to a 1-h lecture plus 1-h bedside teaching session performed significantly better than those assigned to 2-h classroom-based didactic course alone [66,67]. Given current information overload and constraints of curriculum time and resources, an effective teaching model is much needed. Greater emphasis on clinical learning supported by novel didactic components becomes increasingly important [63].

Another shortcoming of current pain education is the lack of quality mentors who can disseminate the clinical knowledge and act as role models. Undergraduates need to be exposed to empathic pain specialists who would present a more comprehensive view of pain medicine and greater depth of engagement [32,68]. Since pain is recognized as a fundamentally intersubjective experience [69,70], understanding compassion may serve as a source of satisfaction for providers [71]

and empathy may boost self-perceived energy levels [72]. Compassionate and empathic mentors as role models can foster these qualities in medical students [32]. They in turn may find treating pain patients can be a rewarding experience.

Despite the fact that pain curricula and core competencies are well established for the graduate levels [73], core pain management competencies for the undergraduate level have not yet been established [74]. The absence of core competencies may partially explain the paucity of pain education found in undergraduate level [74]. This gap necessitates the development of competency-based education (CBE). CBE focuses on the measurable performance of learners, therefore can be linked to desired outcomes for quality improvement [75]. Moreover, with introduction of entrustable professional activates (milestones), incorporation of these milestones into the undergraduate curriculum that flows to the post-graduate level might be ideal. Using a consensus-building process from an interprofessional executive committee, the first core competencies in pain assessment and management for pre-licensure health professional education was developed [74]. These competencies parallel the structure of the interprofessional and uniprofessional pain curricula developed by IASP [40]. They can serve as a reference for developing, defining and revising curricula [74]. The emphasis of CBE in pain education echoes the call for better outcomes measurement in healthcare today [76].

There are several other potential opportunities to advance pain education. We need to debulk the widely misconceived view that pain medicine is not an essential element of medical education but is rather the domain of subspecialty training [32]. This view may reflect the current lack of support of medical education funding and resources [32]. Finally, given the increasing legal and regulatory environment of prescribing practices [77,78], pain curricula should include the medical, clinical, as well as legal aspects of these relevant topics. Support from government through legislation or funding to early medical education in pain may be the best strategies to mitigate the current crisis of over- and underprescription of pain medications.

Conclusion & future perspective

The important role of medical education in pain medicine involves not only answering the 'why' but also should address the 'who', the 'when', the 'what' and perhaps most importantly the 'how'. Pain education is recognized as essential in the battle against the global pain epidemic. It needs to be initiated, mandated and standardized at the earliest stages of medical training in order to capture the broadest, most receptive and impressionable audience since pain is encountered by every specialty. By assessing the current status in pain education and identifying its challenges, we can create opportunities for future innovations. For example, an innovative case based, integrated course for medical students addressing the multidimensional phenomenon of pain (sensory, affective and cognitive) coupled with small group sessions with pain specialists, active-learning approaches to pain knowledge and design-built elements to strengthen emotional skills was found to be highly effective [79]. The complexity of pain behooves us to think outside the box in searching for tangible solutions starting with medical education. It is not radical to consider 'flip the pain curriculum' [80], which calls for the reverse of standard approach to pain education with greater emphasis on the social and psychological aspects of pain than the biological process, in other words, sociopsychobiological model. Evidence from clinical and basic research seems to support this new model [32,81–82] This insight will guide medical education in pain toward a more holistic patient-centered approach with better clinical outcomes.

Finally, it must be recognized that medial education in pain medicine is just an initial step of the multifront battle against the pain crisis. Its recognition, requirement and systematic implementation have been long overdue. The long-term success of improving pain education requires a broad multidisciplinary support from all participants, namely academia/medical education, expert clinicians, administrators, licensure organizations and policymakers. Long-term studies are still much needed to identify the most effective approach in pain education and to assess its ultimate impact upon practice behaviors and how that translates into better outcomes.

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References

Papers of special note have been highlighted as:
• of interest; •• of considerable interest

1 Siddall PJ, Cousins MJ. Persistent pain as a disease entity: implications for clinical management. *Anesth. Analg.* 99(2), 510–520 (2004).

2 Gatchel RJ, Peng YB *et al*. The biopsychosocial approach to chronic pain: scientific advances and future directions. *Psychol. Bull.* 133(4), 581–624 (2007).

3 National Institutes of Health: Blueprint for neuroscience research (2014). www.neuroscienceblueprint.nih.gov

4 Institute of Medicine. *Relieving Pain in America: A Blueprint for Transforming Prevention, Care, Education, and Research.* The National Academies Press, WA, USA (2011).

•• **Calls for a 'cultural transformation' including changes in pain education.**

5 The Gates Foundation: Grand challenges in global health (2014). www.grandchallenges.org

6 Turk DC, Theodore BR. Epidemiology and economics of chronic and recurrent pain. *Clinical Pain Management: A Practical Guide*. Hoboken, Blackwell Publishing, NJ, USA (2011).

7 Leadley RM, Armstrong N, Lee YC, Allen A, Kleijnen J. Chronic diseases in the European Union: the prevalence and health cost implications of chronic pain. *J. Pain Palliat. Care Pharmacother.* 26(4), 310–325 (2012).

8 Stewart WF, Ricci JA, Chee E, Morganstein D, Lipton R. Lost productive time and cost due to common pain conditions in the US workforce. *JAMA* 290(18), 2443–2454 (2003).

9 McDermott AM, Toelle TR, Rowbotham DJ, Schaefer CP, Dukes EM. The burdens of neuropathic pain: results from a cross-sectional survey. *Eur. J. Pain* 10(2), 127–135 (2006).

10 Blyth FM, March LM, Brnabic AJ, Jorm LR, Williamson M, Cousins MJ. Chronic pain in Australia: a prevalence study. *Pain* 89(2–3), 127–134 (2001).

11 Bond MR, Dubner R, Jones LE, Meldrum ML. The history of the IASP: progress in pain since 1975. In: *The Paths of Pain 1975–2005.* Merskey H, Loeser JD Dubner R, (Eds). IASP Press, WA, USA, 503–511 (2005).

12 Brennan F, Carr DB, Cousins M. Pain management: a fundamental human right. *Anesth. Analg.* 105(1), 205–221 (2007).

13 Breivik H, Collett B, Ventafridda V, Cohen R, Gallacher D. Survey of chronic pain in Europe: prevalence, impact on daily life, and treatment. *Eur. J. Pain* 10(4), 287–333 (2006).

14 Stieg RL, Lippe P, Shepard TA. Roadblocks to effective pain treatment. *Med. Clin. North Am.* 83(3), 809–821 (1999).

15 Apfelbaum JL, Chen C, Mehta SS, Gan TJ. Postoperative pain experience: results from a national survey suggest postoperative pain continues to be undermanaged. *Anesth. Analg.* 97(2), 534–540 (2003).

16 Watt-Watson J, Hunter J, Pennefather P *et al*. An integrated undergraduate pain curriculum, based on IASP curricula, for six health science faculties. *Pain* 110(1–2), 140–148 (2004).

17 Benedetti C, Dickerson ED, Nichols LL. Medical Education: a barrier to pain therapy and palliative care. *J. Pain Symptom. Manage.* 21(5), 360–362 (2001).

18 Sessle BJ. Unrelieved pain: A crisis. *Pain Res. Manag.* 16(6), 416–420 (2011).

19 Leila NM, Pirkko H, Eeva P, Eija K, Reino P. Training medical students to manage a chronic pain patient: both knowledge and communication skills are needed. *Eur. J. Pain* 10(2), 167–170 (2006).

20 Reid KJ, Harker J, Bala MM, Truyenrs C, Kellen E, Bekkering GE, Kleijnen J. Epidemiology of chronic non-cancer pain in Europe: narrative review of prevalence, pain treatments and pain impact. *Curr. Med. Res. Opin.* 27(2), 449–462 (2011).

21 Kress HG. The importance of putting pain on the curricula in medical schools in Europe. *J. Pain Palliat. Care Pharmacother.* 27(2), 182–184 (2013).

22 World Institute of Pain Foundation. Declaration of Miami 2012 (2014). www.wipfoundation.org

23 Vadivelu N, Mitra S, Hines R, Elia M, Rosenquist RW. Acute pain in the undergraduate medical education: an unfinished chapter! *Pain Pract.* 12(8), 663–671 (2012).

24 Lippe PM, Brock C, David J, Crossno R, Gitlow S. The first national pain medicine summit – the final summary report. *Pain Med.* 11(10), 1447–1168 (2010).

25 Burge F, McIntyre P, Kaufman D *et al*. Family medicine residents' knowledge and attitudes toward management of cancer pain. *J. Pain Symptom Manage.* 15, 359–364 (1998).

26 Darer JD, Hwang, Hoangmai H, Bass EB, Anderson G. More training needed in chronic care: a survey of US physicians. *Acad. Med.* 79(6), 541–548 (2004).

27 Dobscha SK, Corson K, Flores JA, Tansill EC, Gerrity MS. Veterans affairs primary care clinicians' attitudes toward chronic pain and correlates of opioid prescribing rates. *Pain Med.* 9(5), 564–571 (2008).

28 Upshur CC, Bacigalupe G, Luckmann R. "They don't want anything to do with you": patient views of primary care management of chronic pain. *Pain Med.* 11(12), 1791–1798 (2010).

29 AAMC. Learning objectives for medical student education-guidelines for medical schools: report I of the medical school objectives project. *Acad. Med.* 74(1), 13–18 (1999).

30 Epstein RM, Hadee T, Carroll J, Meldrum SC, Lardner J, Shields CG. "Could this be something serious?" Reassurance, uncertainty, and empathy in response to patients' expressions of worry. *J. Gen. Intern. Med.* 22(12), 1731–1739 (2007).

31 Murinson BB, Agarwal AK, Haythornthwaite JA. Cognitive expertise, emotional development, and reflective capacity: clinical skills for improved pain care. *J. Pain* 9(11), 975–983 (2008).

32 Murinson BB, Gordin V, Flynn S *et al.* Recommendations for a new curriculum in pain medicine for medical students: toward a career distinguished by competence and compassion. *Pain Med.* 14(3), 345–350 (2013).

•• **Its survey from pain medicine leadership generated a new recommended topic list for curricula in pain medicine.**

33 Morley-Forster PK, Pergolizzi JV, Taylor R, Axford-Gatley RA, Sellers EM. Mitigating the risk of opioid abuse through a balanced undergraduate pain medicine curriculum. *J. Pain Res.* 6, 791–801 (2013).

34 Vadivelu N, Sukanua M, Hines R. Undergraduate medical education on Pain Management across the globe. *Virtual Mentor* 15 (5), 421–427 (2013).

35 Barr H, Freeth D, Hammick M, Koppel I, Reeves S. The evidence base and recommendations for interprofessional education in health and social care. *J. Interprof. Care* 20(1), 75–78 (2006).

36 Morrison LJ, Thompson BM, Gill AC. A required third-year medical student palliative care curriculum impacts knowledge and attitudes. *J. Palliat. Med.* 15(7), 784–789 (2012).

37 Sinatra R. Causes and consequences of inadequate management of acute pain. *Pain Med.* 11(12), 1859–1871 (2010).

38 Pilowsky I. An outline curriculum on pain for medical schools. *Pain* 33(1), 1–2 (1988).

39 Turner GH, Weiner DK. Essential components of a medical student curriculum on chronic pain management in older adults: results of a modified Delphi process. *Pain Med.* 3(3), 240–252 (2002).

40 International association for the study of pain (IASP). IASP interprofessional pain curriculum outline (2014). www.iasp-pain.org

•• **Provides as a reference for future curriculum development.**

41 Barzansky B, Veloski JJ, Miller R, Jonas HS. Education in end-of-life care during medical school and residency training. *Acad. Med.* 74(Suppl. 10), S102–S104 (1999).

42 Chang HM. Educating medical students in pain medicine and palliative care. *Pain Med.* 3(3), 194–195 (2002).

43 Galer BS, Keran C, Frisinger M. Pain medicine education among American neurologists: a need for improvement. *Neurology* 52(8), 1710–1712 (1999).

44 Mitka M. "Virtual textbook" on pain developed: effort seeks to remedy gap in medical education. *JAMA* 290(18), 2395 (2003).

45 Mezei L, Murinson BB. Johns Hopkins Pain Curriculum Development Team. Pain education in North America medical schools. *J. Pain* 12(12), 1199–1208 (2011).

46 Briggs EV, Carr EC, Whittake MS. Survey of undergraduate pain curricula for healthcare professionals in the UK. *Eur. J. Pain* 15(8), 789–795 (2011).

47 Watt-Watson J, McGillion M, Hunter J *et al.* A survey of pre-licensure pain curricula in health science faculties in Canadian Universities. *Pain Res. Manag.* 14(6), 439–444 (2009).

48 Symposium on Pain Management Aimed at Medical School Students (2008). www.opa.yale.edu/news/article.aspx?id=5840

49 Briggs E. Whittaker M, Carr E. Pain Education Special Interest Group of the British Pain Society. *Survey of Undergraduate Pain Curricula for Healthcare Professionals in the UK.* The British Pain Society, London, UK (2009).

50 Poyhia R, Kalso E. Pain related undergraduate teaching in medical faculties in Finland. *Pain* 79(2–3), 121–125 (1999).

51 Working Group of the Australian and New Zealand College of Anaesthetists and Faculty of Pain Medicine. In: *Acute pain management: Scientific evidence, (3rd Edition)*. MacIntyre PE, Scott DA, Schug SA, Visser EJ, Walker SM (Eds). ANZCA & FPM, Melbourne, Australia (2010).

52 Vijayan R. Managing acute pain in the developing world. *Pain Clin. Updates* 19(3), 1–7 (2011).

53 Bond M, Acuna MM, Barros N *et al. Education and Training for Pain Management in Developing Countries. A Report by the IASP Developing Countries Taskforce.* IASP Press, WA, USA (2007).

54 Ferrell B, Virani R, Grant M, Vallerand A, McCaffery M. Analysis of pain content in nursing textbooks. *J. Pain Symptom Manage.* 19(3), 216–228 (2000).

55 Upshur CC, Luckmann RS, Savageau JA. Primary care provider concerns about management of chronic pain in community clinic populations. *J. Gen. Intern. Med.* 21(6), 652–655 (2006).

56 Scudds RJ, Schudds RA, Simonds MJ. Pain in the physical therapy (PT) curriculum: a faculty survey. *Physiother. Theory Pract.* 17(4), 239–256 (2001).

57 Herndon CM, Strassels SA, Strickland JM *et al.* Consensus recommendations from the strategic planning summit for pain and palliative care pharmacy practice. *J. Pain Symptom Manage.* 43(5), 925–944 (2012).

58 Wenthur CJ, Cross BS, Vernon VP *et al.* Opinions and experiences of Indiana pharmacists and student pharmacists: the need for addiction and substance abuse education in the USA. *Res. Social Adm. Pharm.* 9(1), 90–100 (2013).

59 Aggarwal VR, Joughin A, Zakrzewska JM, Crawford FJ, Tickle M. Dentists' and specialists' knowledge of chronic orofacial pain: results from a continuing professional development survey. *Prim. Dent. Care* 18(1), 41–44 (2011).

60 Singh RM, Wyant SL. Pain management content in curricula of US schools of pharmacy. *J. Am. Pharm. Assoc. (Washington)* 43(1), 34–40 (2003).

61 International Association for the Study of Pain (IASP). *Curriculum on Pain for Students in Psychology.* IASP, WA, USA (1997).

62 Breuer B, Cruciani R, Portenoy RK. Pain management by primary care physician, pain physicians, chiropractors, and acupuncturists. A national survey. *South Med. J.* 103(8), 738–747 (2010).

63 Doorenbos AZ, Gordon DB, Tauben D *et al.* A blueprint of pain curriculum across pre-licensure health sciences programs: one NIH pain consortium Cener of Excellence in pain education experience. *J. Pain* 14(12), 1533–1538 (2013).

• **Confirms the paucity of pain education across the health sciences curriculum.**

64 Vadivelu N, Kombo N, Hines RL. The urgent need for pain management training. *Acad. Med.* 84(4), 408 (2009).

65 Sloan PA, Plymale M, LaFountain P, Johnson M, Snapp J, Sloan DA. Equipping medical students to manage cancer pain: a comparison of three education methods. *J. Pain Symptom Manage.* 27(4), 333–342 (2004).

66 Wilson JF, Brockopp GW, Kryst S, Steger H, Witt WO. Medical students' attitudes towards pain before and after a brief course on pain. *Pain* 50(3), 251–256 (1992).

67 Hanna M, Donnelly MB, Montgomery CL, Sloan PA. Perioperative pain management education: a short structured regional anesthesia course compared with traditional teaching among medical students. *Reg. Anesth. Pain Med.* 30(6), 523–528 (2005).

68 Corrigan C, Desnick L, Marshall S, Bentow N, Rosenblatt RA. What can we learn from first-year medical students' perceptions of pain the primary care setting? *Pain Med.* 12(8), 1216–1222 (2011).

69 Jackson PL, Rainville P, Decety J. To what extent do we share the pain of others? Insight from the neural bases of pain empathy. *Pain* 125(1–2), 5–9 (2006).

70 Ochsner KN, Zaki J, Hanelin J *et al.* Your pain or Mine? Common and distinct neural systems supporting the perception of pain in the self and other. *Soc. Cogn. Affect. Neurosci.* 3(2), 144–160 (2008).

71 Conrad D, Kellar-Guenther Y. Compassion fatique, burnout, and compassion satisfaction among Colorado child protection workers. *Child Abuse Negl.* 30(10), 1071–1080 (2006).

72 Kearney MK, Weininger RB, Vachon ML, Harison RL, Mount BM. Self care of physicians caring for patients at the end of life: "Being connected…a key to my survival". *JAMA* 301(11), 1155–1164 (2009).

73 Accreditation Council for Graduate Medical Education. Program requirements for graduate medical education in pain medicine (2014). www.acgme.org/acgmeweb

74 Fishman SM *et al.* Core competencies for pain management: results of an interprofessional consensus summit. *Pain Med.* 14(7), 971–981 (2013).

- **It defines consensus-derived core competencies within each pain domains.**

75 Gruppen LD, Mangrulka RS, Kolars JC. The promise of competency-based education in the health professions for improving global health. *Hum. Resour. Health.* 10(1), 43 (2012).

76 Gordon DB, Polomano RC, Pellino TA *et al.* Revised American pain society patient outcome questionaire (APS-POQ-R) for quality improvement of pain management in hospitalized adults: preliminary psychometric evaluation. *J. Pain* 11(11), 1172–1186 (2010).

77 Agency Medical Directors Group. Interagency on opioid dosing for chronic non-cancer pain: an education aid to improve care and safety with opioid therapy (2014). www.agencymeddirectors.wa.gov

78 Zink J. On final day, Florida lawmakers approve bill to crack down on pill mills. Tampa Bay Times (2011). www.tampabay.com/news/health/article1168138.ece

79 Murinson BB, Nenortas E, Mayer RS *et al.* A new program in pain medicine for medical students: integrating core curriculum knowledge with emotional and reflective Development. *Pain Med.* 12(2), 186–195 (2011).

80 Carr DB, Bradshaw YS. Time to flip the pain curriculum. *Anesthesiology* 120(1), 12–14 (2014).

81 Eisenberger NI. The pain of social disconnection: examining the shared neural underpinnings of physical and social pain. *Nat. Rev. Neurosci.* 13(6), 421–434 (2012).

82 Wager TD, Atlas LY, Lindquist MA, Roy M, Woo CW, Kross E. An fMRI-based neurological signature of physical pain. *N. Engl. J. Med.* 368, 1388–1397 (2013).